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Agricultural Situation

An In-depth Look at the Fruit and Vegetable Markets in Shandong Province

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Report Highlights:
China's horticulture industry has grown tremendously over the last thirty years. The market is highly competitive with farmers in Shandong Province able to earn an income through production. The majority of fruits and vegetables are still sold through traditional supply chain channels as opposed to modern channels. In Shandong (and elsewhere in China), there are no stable agricultural labor markets so when a farmer commits to vegetable production, he commits to spend less of his own and his family members' time off the farm. Food safety controls are still a challenge, though the government is working to implement standards.

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Introduction

China's horticultural industry has grown tremendously in the thirty years since the Cultural Revolution ended and the reform period began. There has also been wide-spread emergence of a retail food industry in China since the early 1990s. Similar to many other aspects of China's development, the horticultural industry is unique. The market consists of millions of small-scale farmers mainly selling their products to brokers and wholesalers. Shandong province, where the largest amount of fruit and vegetable commodities are produced, is the focus of this report.

This report looks at four specific commodities: apples, cucumbers, grapes, and tomatoes, and how they are produced and marketed, through traditional or modern supply chains. Also included are observations on the highly competitive market environment and on food safety concerns linked to China's farming structure.

Shandong Province and Focus Commodities

China's number one horticultural production region is Shandong Province located in the northeast, south of Beijing (see Figure 1). It is commonly referred to as the fruit and vegetable basket of China. It was chosen as the focus province for this report for two main reasons. First, Shandong's farmers produce more fruit and vegetables than producers in any other province. In 2006, Shandong's farmers produced 25 million metric tons (MT) of fruits and 85 million MT of vegetables, accounting for about 15 percent and 14 percent of national output respectively (NBSC, 2007). Second, Shandong Province has historically been a marketing leader for fruit and vegetable commodities (Rozelle et al., 2002). The province is perceived as having dynamic markets with forward thinking institutions that are often mimicked by other regions. For example, Shandong officials were among the first to promote greenhouse technology (through grants, subsidies, and extension). Introduction of greenhouse technology allowed farmers to produce off-season horticultural crops, which increased supply on the market and brought farmers higher prices for goods produced.

Figure 1: Map of China's Provinces

In 2005, Shandong was the largest apple and cucumber producer, the second largest tomato producer and the third largest grape producer among China's provinces. The general information about the production and marketing of these specific commodities may be used

to formulate general ideas of the other major horticulture commodities produced in Shandong. In addition to the commodities selected for this report, Shandong is China's lead province for production of peaches, garlic, green onions, eggplant, celery, and spinach, as well as the second largest producer of pears, strawberries, carrots, and cabbage.

Retail Market Trends

Modern retailers, particularly supermarkets, have been emerging in developing countries since the early 1990s (Reardon and Timmer, 2005; Balsevich et al., 2006). In China, supermarkets arrived in the early 1990s and spread as fast as or faster than anywhere in the world (Hu et al., 2004). This retail trend has led to the emergence of modern supply chains. In China the midstream, wholesale sector of the marketing chain has also evolved, though much less rapidly than the retail sector (Huang et al., 2007a). The impact of these modern retailers on downstream segments of the supply chain such as farmers, is not as clear. There are case studies in Latin America, Central and Eastern Europe, Mexico, Brazil, and Kenya that suggest that it is the rich, large farmers that benefit from the rise of demand for fruit and vegetables and the emergence of supermarkets (Reardon and Timmer, 2007; Berdegué et al., 2005; Dries et al, 2004; Schwentesius et al, 2002). It is often assumed that supermarkets and their agents (for example, specialized wholesalers or preferred suppliers) will turn to larger and wealthier farmers because of the higher transaction costs involved with purchasing from millions of small farmers and the difficulty in maintaining quality and food safety when product is sourced from so many different locations. However, China's fruit and vegetable production is, to some extent, unique in its lack of large-scale farms.

Farm Size and Production

The average farm size studied in Shandong Province is 0.4 hectare, with the largest vegetable farm at 1.5 hectares and the largest fruit farm at 2.7 hectares. In California, where the majority of U.S. horticulture products are produced, the average farm size is 140 hectares and in Washington State, the largest apple producer, the average farm size is 172 hectares. The scale of individual farm plots in China, when compared with the United States, is extremely small. In rural China, most households have land contracted from their villages with 30 years of use rights. A few households rent out their contract lands to other farmers which contribute to the 'large' farms ranging from 1.5 to 2.7 hectares. There are however, new farmer cooperative initiatives in place including a new cooperative law that simplifies the regulation and supervision of cooperatives. These efforts should lead to greater income and productivity gains for Chinese farmers.

It is important to note that despite the small farm size and the planting of multiple crops, farmers in Shandong Province are not subsistence farmers. The farmers are earning a living, however small, through their production.

Household Production

1. Who is Producing Vegetables?

There is no distinction among farmers in the level of wealth between vegetable and non-vegetable growing households. China's markets allow equal access to emerging horticulture[1] activities. In 2006, the average cucumber producer's household assets (on a per capita basis—not including the family's house) were $992, for non-cucumber producing households $986 and for tomato producers $1,131, for non-tomato producing households $1,164. The lack of significant differences in assets suggests that there are no entry barriers for farmers to switch to the production of vegetables.

[1] Horticulture in this report refers only to fruits and vegetables.

Vegetable farmers in Shandong normally grow several crops. Major crops are maize, wheat, cotton, peanuts, and vegetables. Within the vegetable category, farmers do not limit themselves to one type. Simultaneously planted vegetables in both greenhouses and open fields, include: Chinese cabbage, peppers, eggplant, string beans, cucumbers, and tomatoes.

Vegetable production is more labor intensive than other types of farming therefore, the availability of family labor is fundamental for farmers who choose to move into vegetable production. Households with a smaller percentage of laborers with off-farm jobs are more likely to produce vegetables because of the physically demanding nature of vegetable production. In Shandong (and elsewhere in China), there are no stable agricultural labor markets so when a farmer commits to vegetable production, he commits to spend less of his own and his family members' time off the farm. Most farmers, however, have limited off-farm employment options. This implies that for those households who are not able to participate in off-farm employment, the expansion of China's vegetable market provides a new employment opportunity.

China's government provides limited support for horticulture production. In the late 1990s, a Vegetable Base Program was started in many rural areas. The program was created to ensure stable supplies of vegetables for urban consumers. The typical method of support is the reduction of in-kind grain taxes. Farmers also receive grants or loans from the government to help invest in inputs needed to produce vegetables. Although the average per capita support for these villages is relatively low, participation in the Vegetable Base Program appears to be higher in those areas with a greater concentration of tomato production. However, the same result was not found for cucumber production areas. The cucumber production areas received far less support. Other research on vegetables indicates that more than 95 percent of all investment into the assets needed to produce vegetables are from individual farmers, not government support programs.

Vegetable production occurrs on the larger of the relatively small farms in Shandong Province. In 2006, average cucumber farms were 0.41 hectare, 27 percent larger than non-cucumber farms (0.32 hectare) and the average tomato farms were 0.57 hectare, 24 percent larger than non-tomato farms (0.43 hectare). The total number of farms producing vegetables has also increased. From 2001 to 2006, the number of farms that planted cucumber rose by 14 percent and tomato producing households rose by 23 percent. Lastly, those farms closer to wholesale markets were more likely to produce vegetables. Thus, state investment into market infrastructure has supported Shandong's horticulture production.

2. Who is Producing Fruit?

Similar to vegetables, wealth has little effect on the decision to produce fruit but off-farm employment does impact fruit production. Lower-levels of household off-farm employment are seen on Shandong's fruit farms. Households producing fruit actually had lower per capita assets than non-producing households, indicating that poorer farmers are not being left out of horticulture production. In 2001, the average apple producing households' assets were $616.30, non-apple producing $734.70 and the average grape producing households' assets were $787.70, non-grape producing $896.10. Like vegetable production, the labor intensive nature of fruit production is the reason fruit producing households have lower levels of off-farm employment.

China's government provides some support for apple but not grape production. During the 1980s, this government support led to large production increases through expanding apple orchard area and encouraging farmers to shift production of other crops (grains, fibers, and oilseeds) to apples. The government encouragement occured in three ways: providing grants and loans to farmers, reducing in-kind grain taxes, and introducing new varieties (Zhang, 2005). This promotion program led to a staggering increase in apple production and

nearly quadrupled production between 1990 and 1996 from 4.3 to 17 million tons (China's Ministry of Agriculture, Online Database). However, the support program was viewed as a failure by government and industry because the dramatic increase in supply depressed both domestic and world apple prices. The growth in apple production has since leveled off with total production in 2006 at 26.1 million tons, a 50-percent increase over the ten year period, 1996-2006. Grape production, not supported by government programs, has risen steadily during the period from 1990 to 2006 from 0.86 to 6.3 million tons, a more than sevenfold increase. This increase occurred without government support.

Unlike vegetable production, farm size is not a factor in fruit production. There is no significant difference in the size of fruit versus non-fruit producing farms in Shandong. Fruit production in Shandong Province has increased since 2001. In the case of apples, this growth has come from an increase in average farm size from 0.18 hectare in 2001 to 0.19 hectare in 2006, as well as better farm management and an increase in farm inputs. The growth in grape production stems from a 14-percent increase in the total number of grape farmers from 2001 to 2006, there was no increase in average farm size for grape producers.

Marketing Choices

In China, there are two main ways a farmer's production enters the supply chain: traditional or modern methods. Traditional marketing channels in this report refer to brokers and wholesalers. Brokers are traveling traders that visit villages and procure product directly from farmers. Wholesalers are those renting stalls and selling from within a market place. Modern marketing channels refer to special suppliers, processing companies, farmer associations, supermarkets, restaurants, and export companies. Please see Figure 2 for a supply chain flow chart.

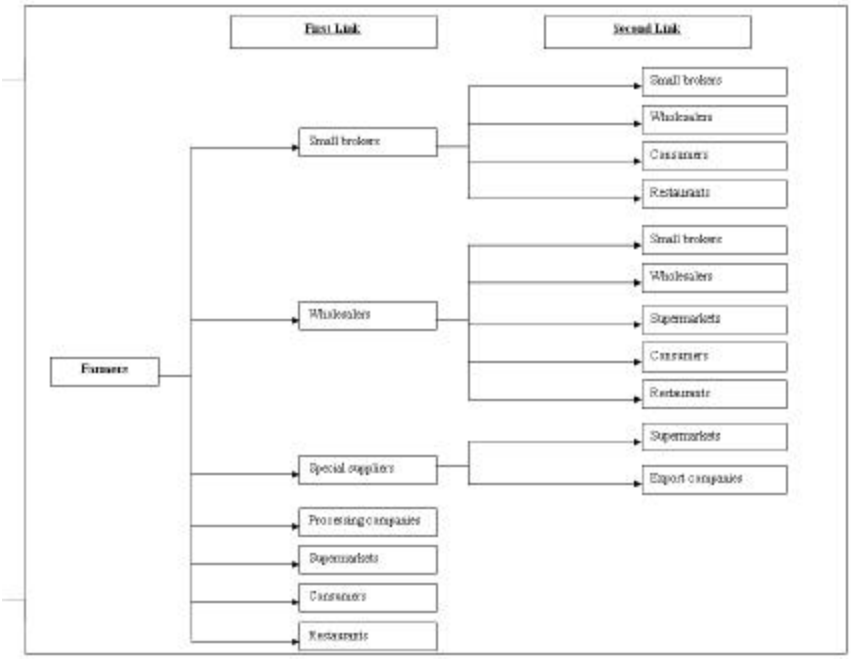
1. How Are Vegetables Entering the Supply Chain?

In general, most cucumbers and tomatoes move through traditional supply channels. The marketing channels of most villages are dominated by small wholesalers and brokers. The markets into which farmers sell their vegetables are dominated by thousands of small traders, particularly in local wholesale markets. In cucumber and tomato producing villages, farmers sold nearly 80 percent of their vegetables to wholesalers. Vegetables sold to small brokers accounted for almost all of the remaining 20 percent of the vegetables marketed by farmers. There are differences between farmers selling to wholesalers and brokers. Those selling to wholesalers use higher levels of pesticides and capital on average, but lower levels of labor. Therefore, capital to labor ratios of those that sell to wholesalers is higher than those that sell to brokers.

The nature of sales inside wholesale markets demonstrates that wholesale markets are fairly traditional and informal. Farmers sell more than one third of their cucumbers and more than one half of their tomatoes to small brokers buying on the periphery of wholesale markets (as opposed to those that rent a stall in the market). Post visits to rural China during the harvest season easily confirm these figures; small traders can be found everywhere.

Modern supply channels, which include special suppliers, processing companies, farmer associations, supermarkets, restaurants, and export companies accounted for less than two percent of cucumber sales and less than one percent of tomato sales between 2001 and 2006. The horticulture market restructuring which has occurred at the retail, wholesale, and processing level in China has not yet reached the village level for vegetable producers.

Figure 2: Supply Chain Flow Chart



For tomatoes however, there is evidence of an increase in modern supply channels when looking at the first and second supply chain links. The second link (the second purchaser of tomatoes on their way to consumers) in the tomato supply chain is often a modern retailer. This suggests that although modern buyers have not penetrated to the farm household level (or into China's rural villages), they are increasingly present in the supply chain. Tomato farmers that sell to the modern chains (through either the first or second buyer) tend to use about 10 percent more capital than those that sell to wholesalers and more than 30 percent more than those that sell to brokers. They also use less labor than those that sell to wholesale markets, 1,821 days/ha (122 days/mu) versus 2,090 days/ha (140 days/mu), and slightly more than farmers that sell to brokers, 1,866 days/ha (125 days/mu) versus 1,716 days/ha (115 days/mu). These capital and labor use trends result in higher overall capital to labor ratios for those farmers that sell to modern chains (3.1 U.S.$/day) than those that sell to brokers (2 U.S.$/day) or wholesalers (2.9 U.S.$/day). The extra income may be invested in future production.

There are also differences in measures of return between those tomato farmers selling into modern channels and those that sell into traditional channels. For those selling into the modern supply chain, net income per fraction of a hectare is double. Farmers earn high returns to capital and higher returns to family labor. These higher returns are due to higher per unit prices. The procurement prices for selling cucumbers and tomatoes to modern chains averaged 0.7 U.S.$/lb in 2001-2006, which is 54 percent higher than that of the "wholesaler to non-modern" chain and 63 percent higher than that of the "broker to non-modern" chain.

Tomato marketing is also becoming vertically integrated. In 2006, 49 percent of all of the tomatoes purchased by wholesalers were purchased in the fields of farmers, while 49 percent was delivered to the wholesale market. In 2001, wholesalers purchased only 38 percent of their total volume from farmers in the field (or at the side of the road near the village), but 58 percent was purchased in the wholesale market. Tomato wholesalers—which make up the dominant part of the market—were increasingly moving out of the wholesale market and

purchasing the crop in the field thus, capturing a larger share of profits. This vertical integration trend was not found in the cucumber villages studied.

Rural market infrastructure development has positive influences on vegetable production expansion. In the villages where households are producing cucumbers, the distance to the nearest wholesale market was 4.6 km in 2005, shorter than that of the non-cucumber-producing villages, 6.2 km. Local investment into marketing infrastructure has stimulated the transformation of the economy toward one with more horticultural production.

2. How is Fruit Entering the Supply Chain?

Most fruit moves through traditional supply channels. In the apple market, there is little penetration of the types of players that are emerging prominently in the downstream segment of the marketing chain, like supermarkets. In 2001 and 2006, apple-producing households sold over 90 percent of their apples in traditional channels. Brokers only accounted for 20 to 25 percent of sales between 2001-2006, whereas small-scale wholesalers accounted for about 70 percent. Only a small share of apples were marketed to processors or other modern supply chain agents. Modern channels, which mainly include processing firms and special suppliers, together accounted for 11 percent in 2006 and only 7 percent in 2001. Farmers selling to the modern channels are receiving a higher price for their output. In 2006, apples were sold at a price between $0.48 and $0.56 per pound to brokers and wholesalers and at a price between $0.66 and $0.68 per poud to processing firms and other modern channels.

The case of grapes is somewhat different. In both 2001 and 2006, 55 percent of grape-producing households' production was sold in traditional channels. Wholesalers accounted for 27 percent of sales and brokers 28 percent. There is a significant and somewhat growing share of grape-producing households selling to processors and other agents from modern marketing channels. The data from the grape-producing villages show that actors in the midstream segment of the modern supply chains do reach down to the farm-gate. Processing firms procured more grapes than any other type of buyer (31 percent), but their share has not increased from 2001 to 2006. Specialized suppliers (typically procurement agents from large wineries) procured 18 percent of production in 2006, an increase from 10 percent in 2001. The average grape price offered by those selling in modern channels is lower than those selling to agents operating in traditional marketing channels. In 2006, grapes were sold at a price between 0.57 and 0.63 $/lb to processing firms and other modern channels and at a price between 0.72 and 0.79 to brokers and wholesalers.

The price difference can be attributed to the nature of the quality of the commodities being marketed through each of the channels. In the case of apples, agents from the modern supply chain focus on procuring larger size and higher quality apples since product is often bound for export. In the grape market, those sold via non-traditional channels are often lower quality wine grapes. When farmers were asked directly what factors contribute to higher fruit prices, nearly all apple and grape growers stated that the price is determined by a combination of fruit size, color (ripeness), and the absence of blemishes.

The nature of these non-traditional buyers, however, is not much different from traditional buyers. Most sales to non-traditional buyers are to traders who represent small local wineries and small local cold storage operations. In some cases the buyer is either a family member or friend of the owner of the winery/cold storage facility. Occasionally buyers for wineries are agents working on commission. Once the wine grape-buying season is over, these agents move to another industry. Essentially, these agents act as small brokers. From this point of view, many of the so-called non-traditional buyers do not represent a significant change in the nature of the buyers to whom producers are selling. The terms and conditions of the sales are the same; all transactions are completed on the spot in cash and most of the

transactions are conducted without contracts. Consistent with this interpretation is that despite the growing number of supermarkets in urban areas, there is no evidence that employees or contractors of supermarkets have penetrated to the village level. In fact, there were zero purchases by agents of supermarkets in most of the villages sampled.

China's Competitive Farmers

China's agricultural and food markets have experienced substantial changes during the past several decades. After nearly 30 years of reform, the domestic agricultural markets have become more efficient and competitive (Park et al., 2002). While there is no absolute proof about what is behind this performance, China's food markets have a number of characteristics that are consistent with well functioning, lightly regulated markets (Rozelle and Huang, 2007). The absence of regulation and the fact that traders do not require substantial amounts of capital to trade make entry easy (Park et al., 2002). When 50 million horticulture farmers are selling to 10 million small traders that operate as brokers, wholesalers, and agents of modern buyers, competition blurs the distinction among marketing channels. Farmers sell to any number of different buyers, and vice versa, because markets offer more or less the same price for similar commodities. Simply put, competitive markets make all farmers—large and small, rich and poor—indifferent between selling to brokers, wholesalers, consumers, or modern buyers.

When farmers are asked if they earn more money in the modern chain, they often state that returns on sales into modern chains are only marginally higher after time, effort, and expenditures are taken into account. This marginal return is the result of the highly competitive markets created by the thousands of farmers and their product in the agriculture sector. The highly competitive markets drive down the returns on production to only the marginal return to land, family labor, and the farmer's own capital investment.

Caveat on Food Safety

There is an important caveat to this market structure. This small and often poor farmer-friendly horticultural economy that is producing enormous amounts of fruit and vegetables faces food safety concerns. While China's government recognizes the importance of food safety and is committed to maintaining high standards, implementation is a challenge. With most of the transactions being characterized as a pure spot market, it can be difficult to maintain traceability. Often, there is no way for fruit and vegetable farmers to be held accountable once their commodities are passed to traders in exchange for cash.

In the case of fruits studied, less than one percent of the time was there an attempt by apple buyers (those in traditional or non-traditional channels) to assess pesticide residue on the fruit they purchased. Only one to two percent of the time (including transactions between grape growers and processors), did a grape buyer attempt to assess pesticide residue. Not one farmer interviewed or surveyed had ever had his apples or grapes tested, the same is true for the traders in wholesale markets. There is, however, a distinction between production for domestic versus international markets. There are strict standards that fruit and vegetables grown for export must go through before they are shipped. The fact that this distinction exists suggests that eventually the government will be able to establish higher food safety standards for domestic production as well. Also, increasingly wholesale markets are requiring testing to improve food safety and hold producers accountable to a certain level of standards.

Conclusion

The demand for horticulture products is growing in China and in the world market. One factor contributing to the growth in demand is the rapid expansion of the retail food sector throughout the world. China's horticulture production is fueled by this growth. The thousands of small-scale fruit and vegetable farmers in Shandong Province represent a

unique market structure. Due to the sheer volume of farmers, earning potential is minimized. Tight profit margins result in a lack of willingness to modernize the retail sector at the farm level and there is little benefit to farmers to supply the modern channels that do exist. In other developing countries, the burgeoning retail market sector has led supermarkets and their agents to turn to larger and wealthier farms to reduce transaction costs and minimize difficulty monitoring quality and food safety. China lacks large-scale farms and thus, economies of scale yet, its small-scale farmers are still able to earn a living growing fruits and vegetables.

A further distinctive quality of China's domestic horticulture market structure is the lack of traceability with regards to food safety. Though the Administration for Quality Supervision, Inspection and Quarantine has recently implemented mandatory orchard, packing house, and processing facility registration for all fruit destined for export markets, the domestic market is still lacking quality control measures. In the majority of cases, the thousands of small-scale farmers selling to hundreds of local brokers and wholesalers are still largely unaccountable for the quality of their produce.

Greater and more efficient production in many parts of the world was achieved through land consolidation. This, however, is not currently an option for China. Land consolidation would mean the distribution of land rights and, most likely, follow with millions of farmers selling their land. If millions of farmers were to simultaneously sell their land and migrate to the cities, this would cause an impossible strain on already stretched urban resources. Farm land is a piece of security for not only the rural residents residing and working on the land but also those rural migrants who are in urban areas attempting to earn a higher standard of living. The piece of land rural migrants have to return to (whether their own or a family member's) is a type of safety net. With a population of 1.3 billion, increasing inflation of consumer good prices, and no established social welfare safety net— stability is the foremost objective of the government.

The future of China's horticulture expansion lies with the development of farmer cooperatives from which branding initiatives might develop, the creation and enforcement of state-certified standards for horticulture production practices, crop insurance, and vertical supply chain integration.

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